

REMARKS

Claim 4 has been canceled. Claims 1-3 and 5-22 are currently pending. Claims 20-22 have been withdrawn from consideration.

Claims 1-18 have been rejected under 35 U.S.C. §112, second paragraph as allegedly being indefinite. While the applicant's do not agree with this rejection, in order to further prosecution Claims 1 and 10 have been amended. As amended, these claims recite determining if the measured thickness or calculated change in thickness of the oxidized nitrided gate oxide layer exceeds a *target thickness value*. It is respectfully submitted that Claims 1 and 10 as amended meet the requirements of 35 U.S.C. §112, second paragraph. Accordingly, reconsideration and withdrawal of the rejections of Claims 1-18 are therefore respectfully requested. The aforementioned amendments to Claims 1 and 10 do not narrow the scope of these claims but merely clarify the invention(s) defined by these claims.

Claims 7-11 have been rejected under 35 U.S.C. §112, second paragraph as allegedly being indefinite. According to the Official Action, there is allegedly insufficient antecedent basis for the phrase "the initial gate oxide thickness" in Claims 7 and 11. Claims 7 and 11 have been amended to recite "determining *an* initial gate oxide thickness. It is respectfully submitted that Claims 7 and 11 as amended meet the requirements of 35 U.S.C. §112, second paragraph. Accordingly, reconsideration and withdrawal of the rejections of Claims 7-11 are therefore respectfully requested. The aforementioned amendments to Claims 7 and 11 do not narrow the scope of these claims but merely clarify the invention(s) defined by these claims.

Claims 1, 3-7, 9, 10 and 12 have been rejected under 35 U.S.C. §102(a) as allegedly being unpatentable over Yasushi. This rejection is respectfully traversed.

First, as noted above, Claim 4 has been canceled. Independent Claims 1 and 10, as amended, each recite nitriding a gate oxide layer on a semiconductor substrate using nitric oxide (NO) gas. Yasushi does not teach or reasonably suggest a method as set forth in either of Claims 1 or 10 which comprises nitriding a gate oxide layer on a semiconductor substrate using nitric oxide (NO) gas. As set forth in the English language Abstract of Yasushi, the oxynitride film in Yasushi is formed by heating the oxide film in a *nitrous oxide* atmosphere (Abstract of Yasushi). Accordingly, it is respectfully submitted that Claims 1 and 10 are patentable over Yasushi.

Claims 3, 5-7, 9 and 12 depend either directly or indirectly from Claim 1. Each of these claims are therefore also patentable over Yasushi for at least the reasons set forth above with respect to Claim 1. Reconsideration and withdrawal of the rejections of Claims 1, 3, 5-7, 9, 10 and 12 are therefore respectfully requested.

Claims 8 and 11 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Yasushi. This rejection is respectfully traversed.

First, Claims 8 and 11 depend from Claims 1 and 10, respectively. Accordingly, these Claims are patentable over Yasushi for at least the reasons set forth above with respect to Claims 1 and 10.

In addition, Claims 8 and 11 can be further distinguished from Yasushi. In particular, as acknowledged in the Official Action, Yasushi fails to disclose measuring the initial gate oxide thickness before nitridation as set forth in Claim 8 or estimating the initial gate oxide thickness from previously collected gate oxide thickness data as set forth in Claim 11 (See Numbered Paragraph 4, pp. 7-8 of the Official Action). Further, the Official Action has provided no motivation for modifying Yasushi to arrive at a method as defined by Claims 8 and 11.

Accordingly, it is respectfully submitted that the Official Action has failed to establish a *prima facie* case of obviousness for the rejection of these claims. Reconsideration and withdrawal of the rejections of Claims 8 and 11 are therefore respectfully requested.

Claims 2 and 14-18 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Yasushi in view of Wolf et al., Silicon Processing for the VLSI Era (hereinafter referred to as “Wolf”). This rejection is respectfully traversed.

First, each of Claims 2 and 14-18 depend directly or indirectly from Claim 1. Further, the Official Action has pointed to no teaching or suggestion in Wolf which would remedy the above noted deficiency of Yasushi. In particular, the Official Action is merely relying upon the disclosure in Wolf of the use of RTP to grow gate oxides and oxynitrides (pg. 9 of the Official Action). Accordingly, Claims 2 and 14-18 are patentable over the cited references for at least the reasons set forth above with respect to Claim 1.

Further, as set forth in the previously filed amendment, Wolf discloses that “. . . the thickness of the nitrided films remains basically unchanged during the reoxidation step” and that only if “excessive reoxidation” takes place can thermal oxidation resume (pg. 649, 2nd full paragraph of Wolf). Therefore, in our opinion, one of ordinary skill in the art would not have been motivated to combine the references in the manner set forth in the Official Action to arrive at the invention as defined by these claims. In particular, Wolf, which discloses that the thickness of the nitrided film remains basically unchanged during reoxidation, teaches away from the proposed combination with Yasushi which, according to the Official Action, discloses determining the *change in thickness* of an oxide layer upon reoxidation. It is well established that a reference must be considered in its entirety, including portions that lead away from the claimed

invention. Additionally, there would have been no reasonable expectation of success in view of the above cited disclosure in Wolf to combine the reference teachings in the manner set forth in the Official Action.

In the “Response to Arguments” section of the Official Action, it is asserted that Wolf “was not cited for a change in thickness of a nitrided layer during a reoxidation step” and that Wolf “was merely cited to show that it is well known within the art that nitrided gate oxide layers are reoxidized” (pg. 23, numbered paragraph 7 of the Official Action). However, as set forth above, a reference must be considered *in its entirety*, including portions that lead away from the claimed invention. Further, as set forth in the MPEP, “[t]he test for obviousness is what the combined teachings of the references would have suggested to one of ordinary skill in the art, and all teachings in the prior art must be considered to the extent that they are in analogous arts” (MPEP §2143.01). Therefore, it is respectfully submitted that the Official Action has failed to establish a *prima facie* case of obviousness for the rejection of these claims.

Claim 13 has been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Yasushi in view of Wolf and further in view of Quirk et al., “Semiconductor Manufacturing Technology” (hereinafter referred to as “Quirk”). This rejection is respectfully traversed.

Claim 13 depends from Claim 1. Further, the Official Action has pointed to no teaching or suggestion in Quirk which would remedy the above noted deficiencies of Yasushi and Wolf. In particular, the Official Action is merely relying upon the disclosure in Quirk of boron doping of a polysilicon electrode (pg. 12 of the Official Action). Accordingly, Claim 13 is patentable over the cited references for at least the reasons set forth above with respect to Claim 1.

Claim 19 has been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent No. 5,862,054 issued to Li (hereinafter referred to as “Li”) in view of Yasushi. This rejection is respectfully traversed.

Claim 19, as amended, recites nitriding a gate oxide layer on a semiconductor substrate using nitric oxide (NO) gas to form the nitrided gate oxide layer on the substrate. Yasushi does not teach or reasonably suggest a method as set forth in Claim 19 which comprises nitriding a gate oxide layer on a semiconductor substrate using nitric oxide (NO) gas. As set forth in the English language Abstract of Yasushi, the oxynitride film in Yasushi is formed by heating the oxide film in a *nitrous oxide* atmosphere (Abstract of Yasushi). Further, the Official Action has pointed to no teaching or suggestion in Li which would remedy this deficiency in Yasushi. Accordingly, it is respectfully submitted that Claim 19 is patentable over Li in view of Yasushi.

Claims 1-6, 12 and 14-18 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent No. 6,528,433 issued to Gartner et al. (hereinafter referred to as “Gartner”) in view of Wolf. Claims 7-9 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Gartner in view of Wolf and further in view of U.S. Patent No. 5,904,523 issued to Feldman et al. Claim 13 has been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Gartner in view of Wolf and further in view of Quirk and Claim 19 has been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent No. 5,862,054 in view of Gartner and further in view of Wolf. Each of these rejections is respectfully traversed.

In particular, each of the aforementioned rejections relies upon the combination of Gartner and Wolf. According to the Official Action, Gartner allegedly teaches calculating the change in thickness of an oxidized oxynitride layer (pg. 14 of the Official Action). However, as set forth above, Wolf, discloses that the thickness of a nitrided film remains basically unchanged during reoxidation. Wolf therefore teaches away from the proposed combination with Gartner. Accordingly, the Official Action has also failed to establish a *prima facie* case of obviousness for the rejection of these claims over Gartner in view of Wolf.

Further, the Official Action has pointed to no teaching in any of the cited references of a method as set forth in either of independent Claims 1, 10 or 19 which comprises nitriding a gate oxide layer on a semiconductor substrate using nitric oxide (NO) gas. Accordingly, it is respectfully submitted that these claims, as well as claims dependent therefrom, are patentable over the cited references.

CONCLUSION

Applicants submit that all of the pending claims of this application are now in condition for allowance and respectfully request that the Examiner take action indicating the same. If any points remain at issue, however, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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